Newfoundland Sea Cucumber Drag Reference Manual

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by

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ABSTRACT

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Sea cucumber *Cucumaria frondosa* are widely distributed throughout the waters of Newfoundland and Labrador and are currently harvested and monitored in several areas using a mobile sea cucumber drag. The following manual documents the development and history of the sea cucumber drag in Newfoundland. Detailed information on the materials and construction of the drag are provided, including descriptions and diagrams of the front end ironwork, chain grid, chaffing matt, and net bag.

RÉSUMÉ

Barrett, L., Way, E., and Winger, P.D. 2007. Newfoundland sea cucumber drag reference manual. Can. Tech. Rep. Fish. Aquat. Sci. 2736: 22 p.

Le concombre de mer *Cucumaria frondosa*, très répandu dans les eaux de Terre-Neuve-et-Labrador, est actuellement récolté et inventorié dans différentes zones à l'aide d'une drague mobile à holothuries. Le manuel suivant documente le développement et l'histoire de ce dragage. Des informations détaillées sur les matériaux utilisés et la méthode de construction de la drague sont incluses, y compris les descriptions et les schémas de la ferrure frontale, de la grille, du paillet de portage et du filet.

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INTRODUCTION

Sea cucumber *Cucumaria frondosa* are widely distributed throughout the waters of Newfoundland and Labrador. In several areas, a mobile drag is used to harvest and monitor the resource, including the southern coast of Newfoundland (DFA 2001, 2002), the southern coast of Labrador (DFA 2004a), and the Strait of Belle Isle (DFA 2003, 2004b). The gear is used as both a commercial fishing gear as well as a scientific survey instrument for the estimation of population abundance and distribution.

Obtaining a reliable index of population abundance is a crucial step in the successful development of this new emerging fishery. In order to reduce variation in population estimates and improve the accuracy and reliability of the survey time-series, it is important that the sea cucumber drag perform consistently from tow to tow, and from year to year. Standardization of the materials and construction of the drag can help achieve this goal.

The purpose of this manual is to outline in detail the materials and construction of the Newfoundland sea cucumber drag. It is intended to:

1) Document the scientific survey instrument in order that it may be duplicated / repaired without error or bias.

2) Assist fabricators in their construction of the drag as well as harvesters in their repairs when damaged.

HISTORY OF THE NEWFOUNDLAND SEA CUCUMBER DRAG

THE MAINE, USA, CONNECTION

The sea cucumber drag fishery in Maine, USA, began around the year 1988. Initially there were concerns related to by-catch and this led to gear conflicts with local lobster fishers. To address these concerns, a gear type used for dragging green sea urchins was modified for the sea cucumber fishery which resulted in an acceptable reduction in by-catch.

In Newfoundland and Labrador, an exploratory sea cucumber fishery started in the year 2001 by the Provincial Department of Fisheries and Aquaculture (DFA) in NAFO sub-division 3Ps. Permission was granted by Fisheries and Oceans Canada (DFO) to use Labrador scallop buckets as the towed gear method. In the following year, contact was made with harvesters in Maine to gather information on their fishery, particularly the modified sea urchin drag used to harvest sea cucumbers. During the fall 2002 Maine fishery, DFA representatives

visited local harvesters in Maine, completed a day trip in the Winter Harbor area and were impressed with the gear's catch rates and by-catch levels.

NEWFOUNDLAND SEA CUCUMBER DRAG DESIGN EVOLVES

Using photographs, video, and detailed measurements of the drag used in Maine, DFA produced a set of drawings and materials list for a local fabricator in Grand Bank, NL to build a similar gear type. Modification to the design was necessary to suit local NL fisher's preferences, their vessel gantry designs, and towing conditions on St. Pierre Bank.

The design was reviewed and approved by DFO and in November 2002 permission was granted to carry-out a gear demonstration test fishery onboard the *FV "Bradley Venture"* off Dantzic Point and on St. Pierre Bank in NAFO sub-division 3Ps. Catch rates and by-catch were compared with two other vessels fishing commercially, one using Labrador scallop buckets and the other using Digby scallop buckets (DFA 2001, 2002). Results of the study were positive and Fisheries and Oceans Canada (DFO) approved the new Newfoundland sea cucumber drag design.

In 2003, identical rigs were built by local fabrication shops and given to eight harvesters on the southern coast of Newfoundland for use in the science based sea cucumber fishery as part of DFO's Emerging Fisheries Policy (DFA 2001, 2002). This same design was used for experimental surveys conducted along the southern coast of Labrador (DFA 2004a), and the Strait of Belle Isle (DFA 2003, 2004b). Other than a slight alteration in twine size to ensure that twine was readily available to harvesters as an off the shelf item, the design has been adopted as the standard tool to carry out stock assessment and other related studies for sea cucumber (see Figure 1).

Underwater video observations of the cucumber drag in action were recorded on St. Pierre Bank in 2005 (CSAR 2006). Preliminary observations indicate that the drag is very efficient in the early part of the capture process. Cucumbers that were available to the gear (within the swept area) were fully vulnerable to capture. The shoe or cutting bar of the drag had very good contact and rarely bounced or lost contact with the seabed. Most sea cucumbers were seen to pass over the cutting bar and become immediately waterborne as a result of contact with the bar and/or chain grid. Observations of mesh selection in the twine bag were not possible due to the orientation of the camera.

DRAG GEAR SPECIFICATIONS

FRONT END IRONWORK

The front end of the sea cucumber drag consists of a number of components constructed out of mild steel, with some tempered steel added for reinforcement. The tempered steel also provides resistance to premature wear due to bottom contact abrasion (Figure 2-4). The main frame consists of 1.5" round stock mild steel (Figure 5). Attached to the frame are skis constructed of 3/8" x 3" mild steel with an additional component of tempered steel added for reinforcement/wear (Figures 6, 8, 9, 10). Directly behind the skis is the rock excluder which consists of both horizontal and vertical bars of 1" round stock mild steel (Figure 11). On the bottom of the rock excluder is a 3/8" x 3" flat bar of tempered steel, referred to as the shoe or cutting bar. Welded to the shoe are thirteen (13) tempered steel protection tabs measuring 3/8" x 3" x 3" at appropriate spacing to prevent accelerated wear to the shackles which connect the front end to the chain grid (Figure 11 and 13). The twine bag lacing rim (Figures 6 and 7) is constructed out of mild steel round rod. In the original design, the lacing rim had a diameter of 1/2", but in 2006 was increased to 3/4" to increase structural integrity.

CHAIN GRID

Attached to the front end ironwork of the drag is the chain grid (Figure 5). The grid is connected to the front end using 3/8" shackles and has overall dimensions of 6' wide x 5' long (Figure 12 and 13). There are thirteen (13) vertical chains measuring 5' in length overall including connecting shackles on both ends (i.e. to connect to both the cutting bar and chaffing matt). The vertical chains are 3/8" in size and are spaced 6" apart (center to center), except for the end chains which are slightly closer on the cutting bar only and spaced at 5" centers from the adjacent chains (Figure 12 and 13).

There are eight (8) transverse chains measuring 6' in length including connecting shackles on both ends (Figure 12). The chains are 3/8" in size and are spaced 7.5" apart (center to center). Vertical chains lay on top of the transverse chains and are connected at their intersections using shackles 3/8" in size (Figure 13).

Two (2) shackles on the outer vertical chains (connecting to the chaffing mat) are 1/2" to denote a corner connecting link and are included in the overall length of both the vertical chain and transverse chain (Figure 12).

CHAFFING MAT

The chaffing mat is attached directly aft of the chain grid and is connected to the grid between the two (2) 1/2" corner shackles referred to above with 3/8" shackles (Figure 5). The mat is 6' wide x 8' long consisting of interlocking steel rings and rubber discs (Figure 14). Three (3) rubber discs connect both vertically and horizontally to adjacent steel rings for a combined total of twelve (12) rubber discs to connect to each steel ring, and nine (9) rubber discs on the edge rings. Steel rings are approximately 3.54" (9 cm) in diameter and rubber discs are approximately 2.36" (6 cm) in diameter.

NET BAG

The net bag consists of a top and bottom panel made of 6mm diameter braided polyethylene (PE) netting. Mesh size is 100 mm knot centre to knot centre with an inside stretched mesh length of 84.25 mm. It is sewn along the bag lacing rim and chain grid, tapering toward a codend which lies above the chaffing mat. Details of the panels shapes and number of meshes deep and wide, are shown in Figures 15 and 16. Hanging ratios and mounting instructions are also shown. One round of codend mesh shall be added to facilitate easy closing of the codend.

REFERENCES

CSAR, 2006. Habitat utilization and density of sea cucumber (*Cucumaria frondosa*) on St. Pierre Bank, Newfoundland: observations using a towed camera sled in 2004 and 2005. CSAR Technical Report P-172, 16p.

DFA, 2001. Dive harvest – Notre Dame Bay; Labrador Bucket – Placentia Bay and St. Pierre Bank. Department of Fisheries and Aquaculture, Government of Newfoundland and Labrador. Project Report: FDP 358-4.

DFA, 2002. Dive harvest – Bonavista and Notre Dame Bays; Towed Gear Design and Testing – Dantzic Point and St. Pierre Bank. Department of Fisheries and Aquaculture, Government of Newfoundland and Labrador. Project Report: FDP 424-3.

DFA, 2003. Sea cucumber survey, Strait of Belle Isle, September to November 2003. Department of Fisheries and Aquaculture, Government of Newfoundland and Labrador. Project Report, 34p.

DFA, 2004a. Sea cucumber exploratory survey – South Labrador Coast. Department of Fisheries and Aquaculture, Government of Newfoundland and Labrador. Project Report, 43p.

DFA, 2004b. Sea cucumber survey, Strait of Belle Isle, August – September 2004. Department of Fisheries and Aquaculture, Government of Newfoundland and Labrador. Project Report, 39p.

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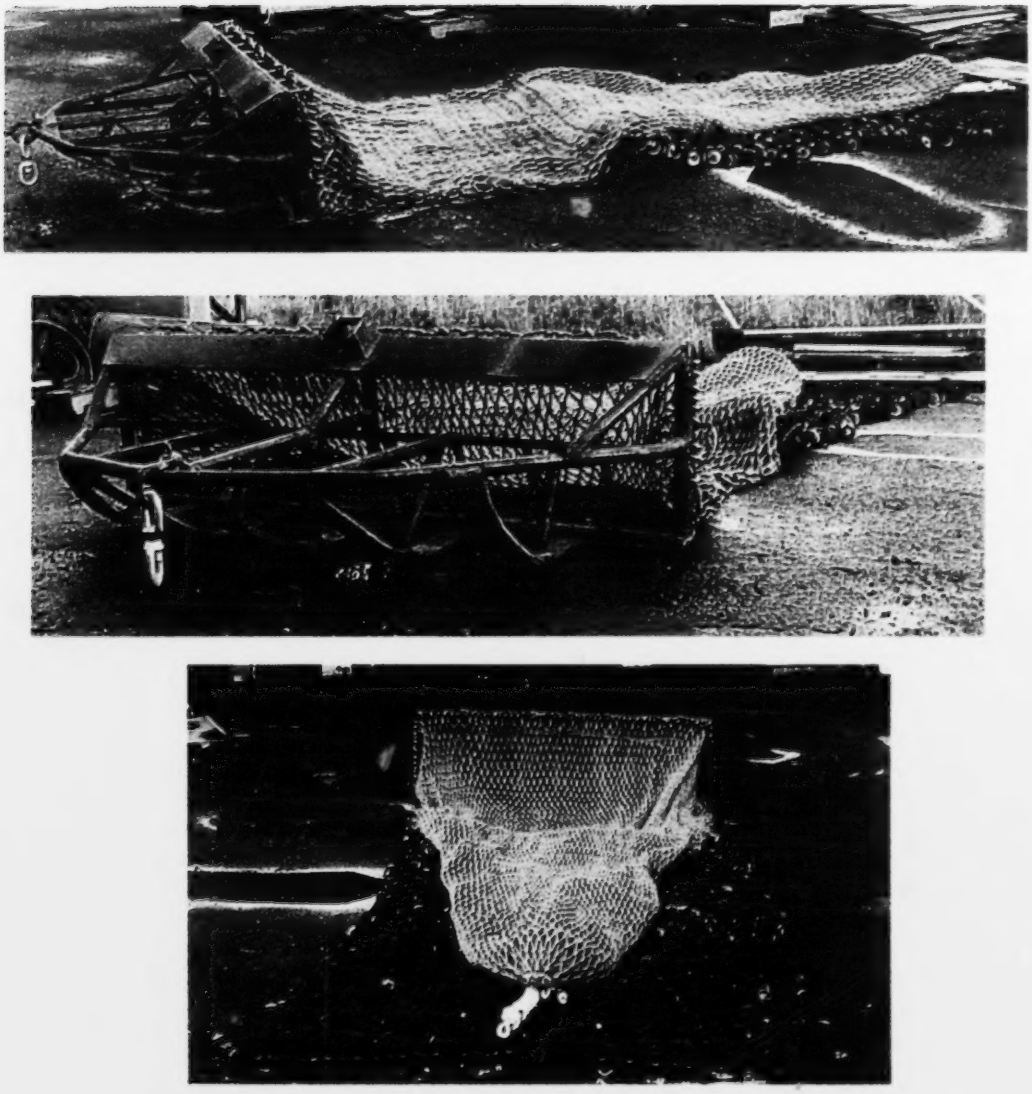

Figure 1: Photographs of the Newfoundland sea cucumber drag viewed from the side, front, and rear, respectively.

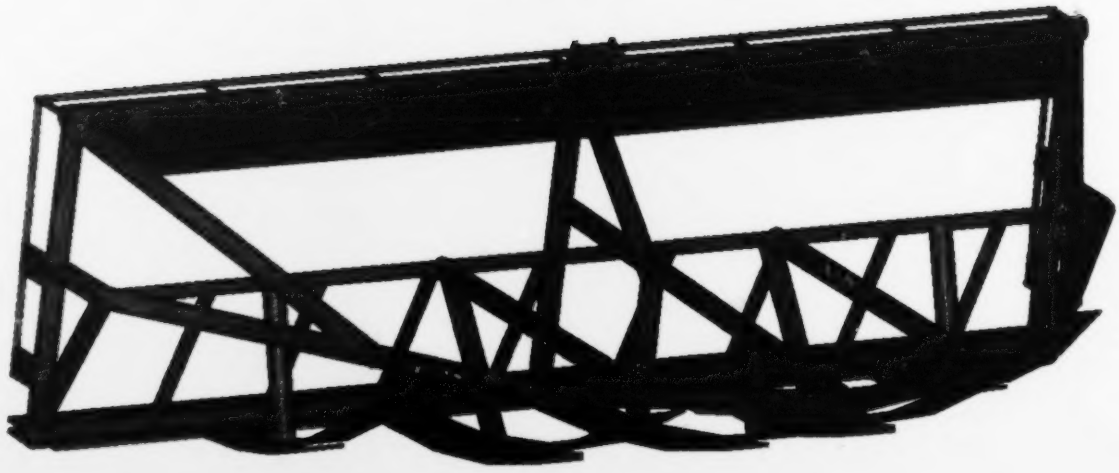

Figure 2: Front end ironwork of the drag viewed from the front.

Figure 3: Front end ironwork of the drag viewed from the back.

Figure 4: Front end ironwork of the drag viewed upright.

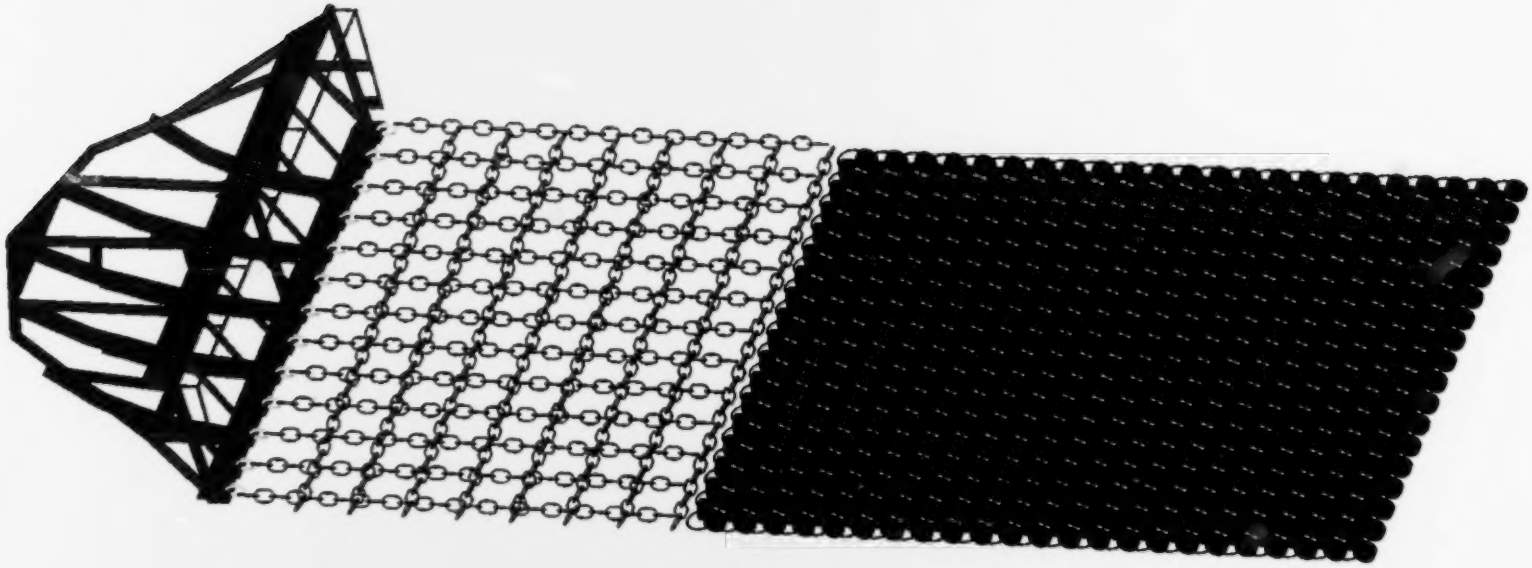

Figure 5: Entire view of sea cucumber drag (excluding net bag) including the front end, chain grid, and chaffing mat.

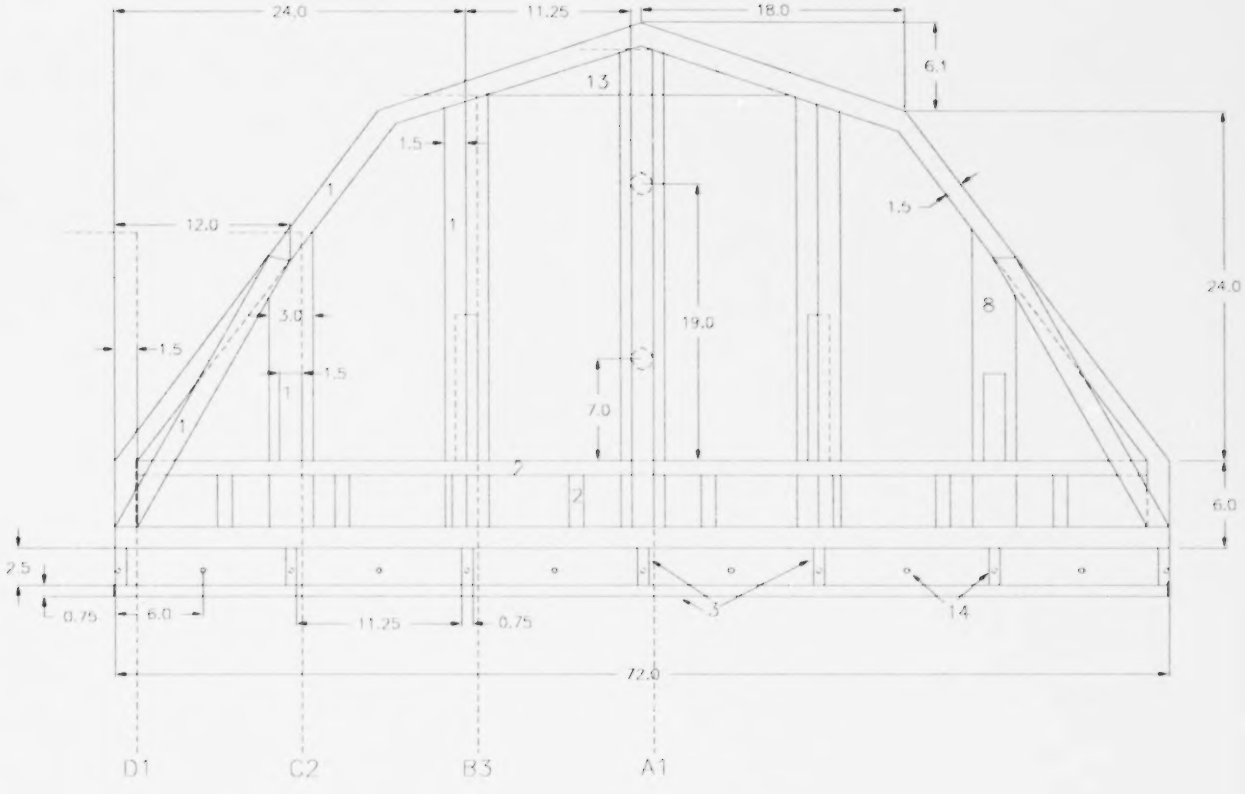

Figure 6: Top view of drag showing dimensions of the main parts. All dimensions are in inches.

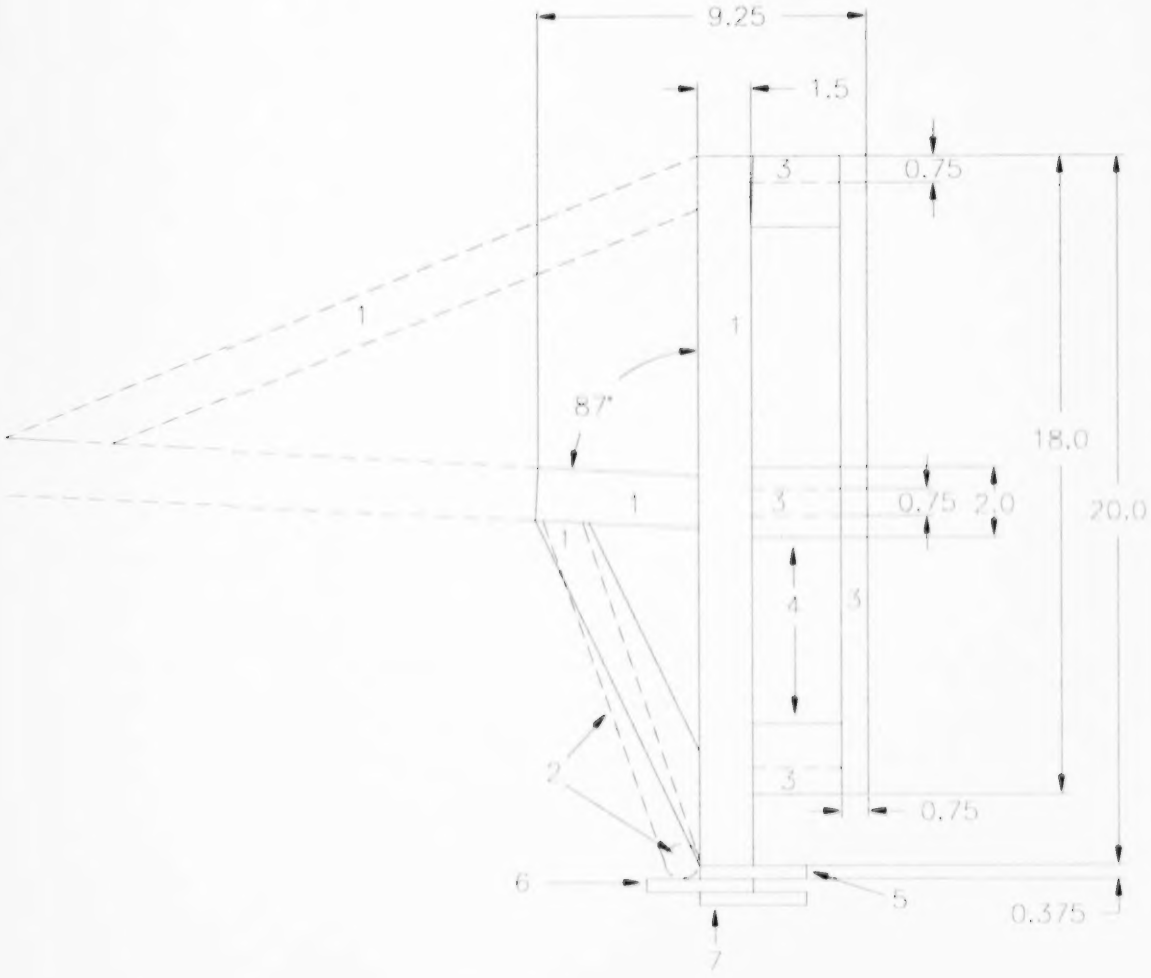

Figure 7: Sectioned view of section D1, showing the side view of this section indicating parts and dimensions. All dimensions are in inches.

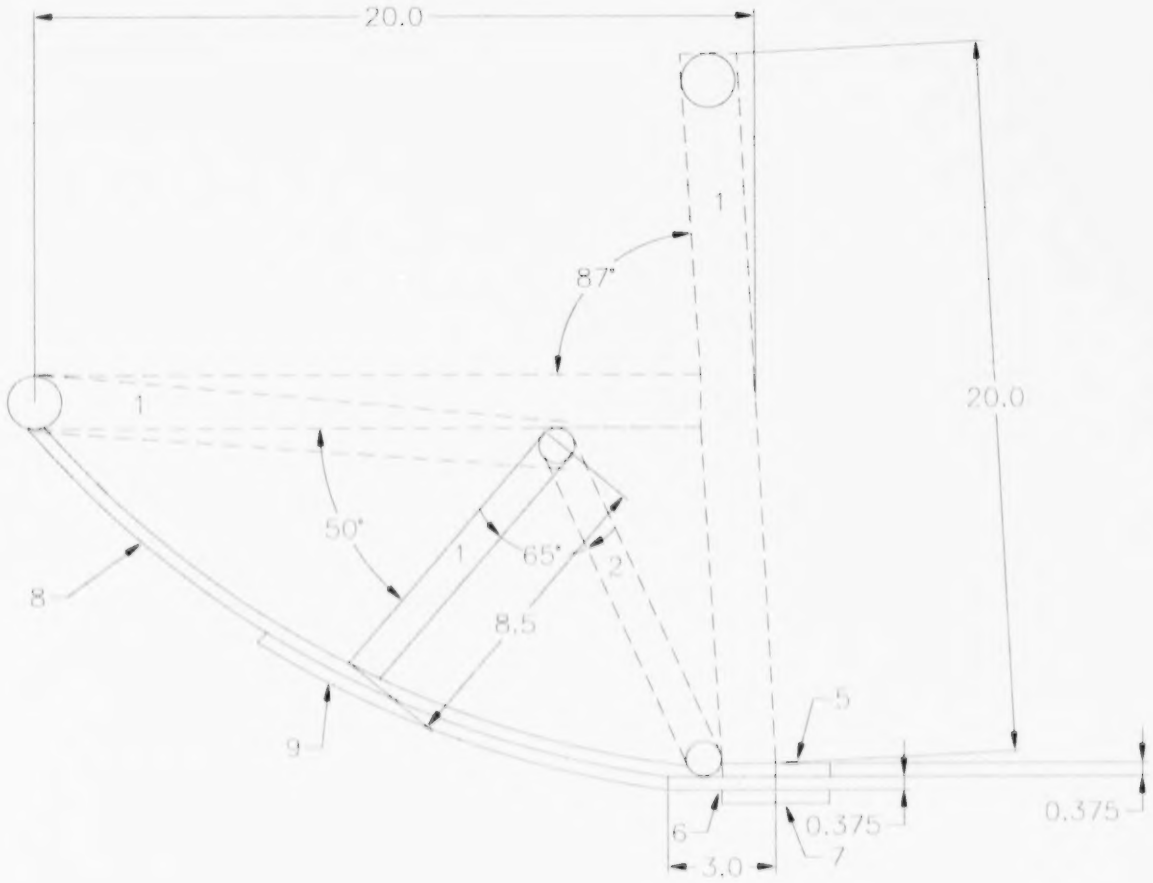

Figure 8: Sectioned view of section C2, showing the side view of this section indicating parts and dimensions. All dimensions are in inches.

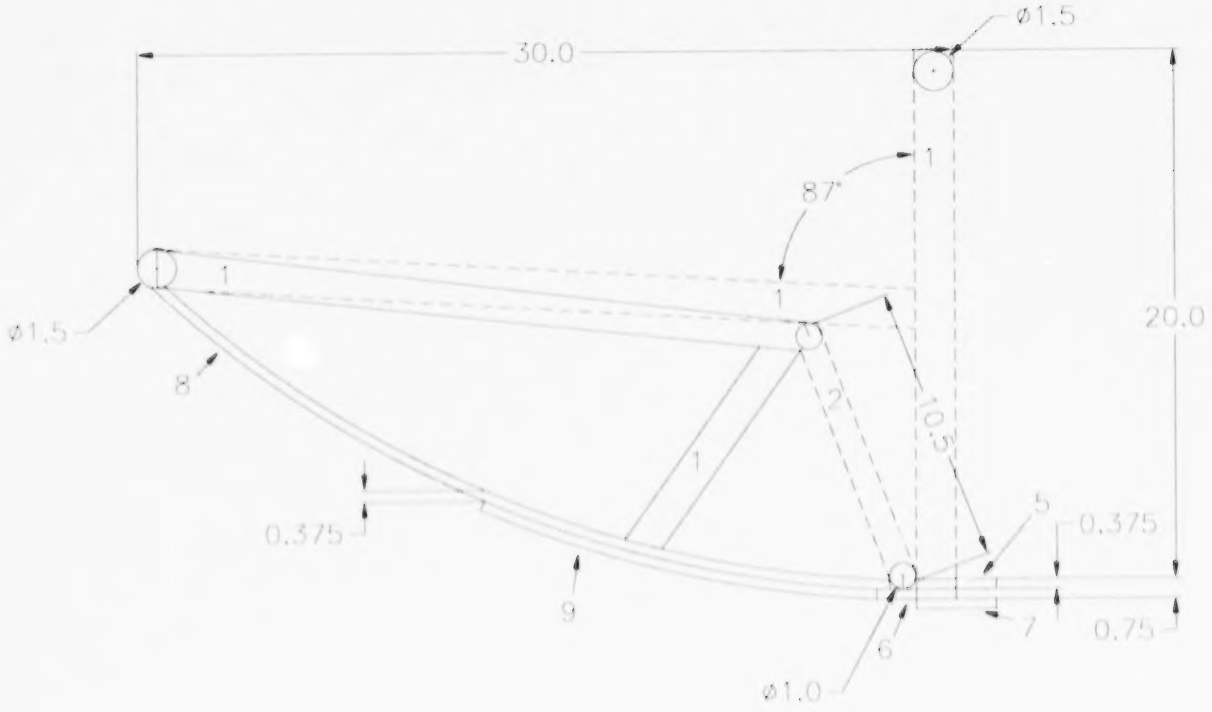

Figure 9: Sectioned view of section B3, showing the side view of this section indicating parts and dimensions. All dimensions are in inches.

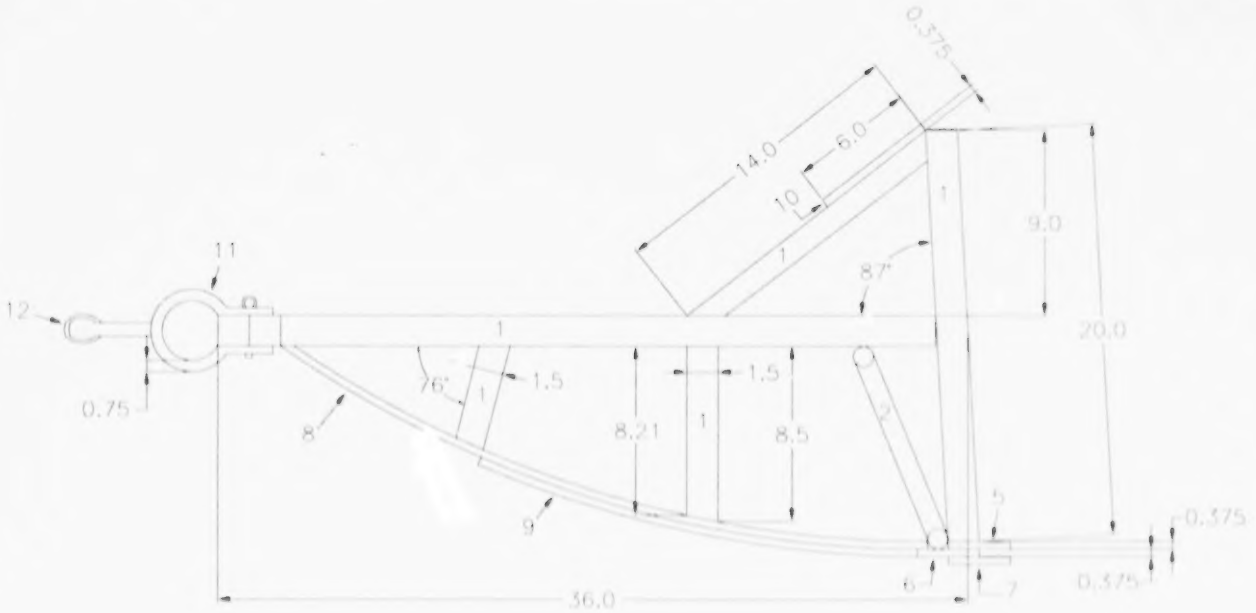

Figure 10: Section A4, showing the section view of the centre profile section, indicating parts and dimensions. All dimensions are in inches.

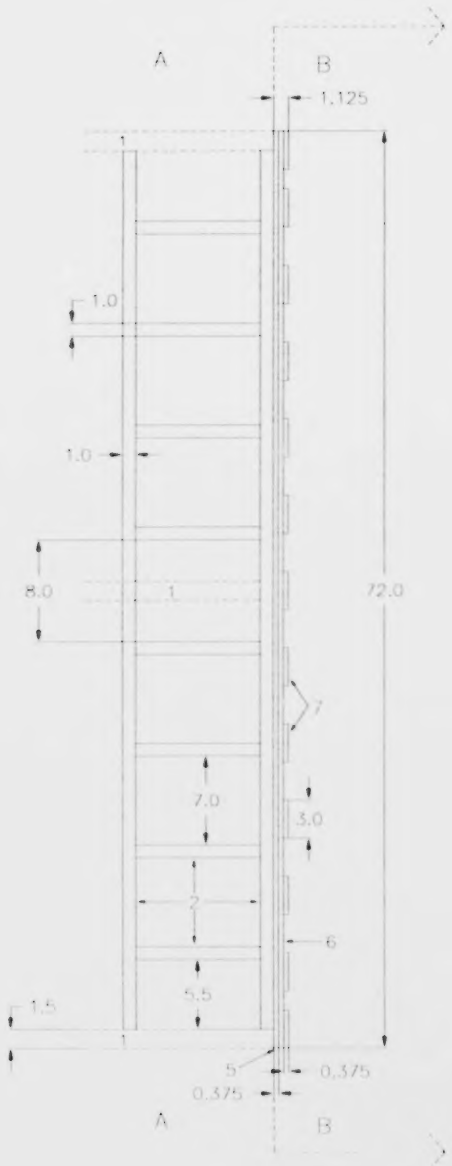

Figure 11: (A) Rock excluder rotated with respect to vertical. (B) Bottom shoe and protection tabs showing true length and orientation (not rotated). All dimensions are in inches.

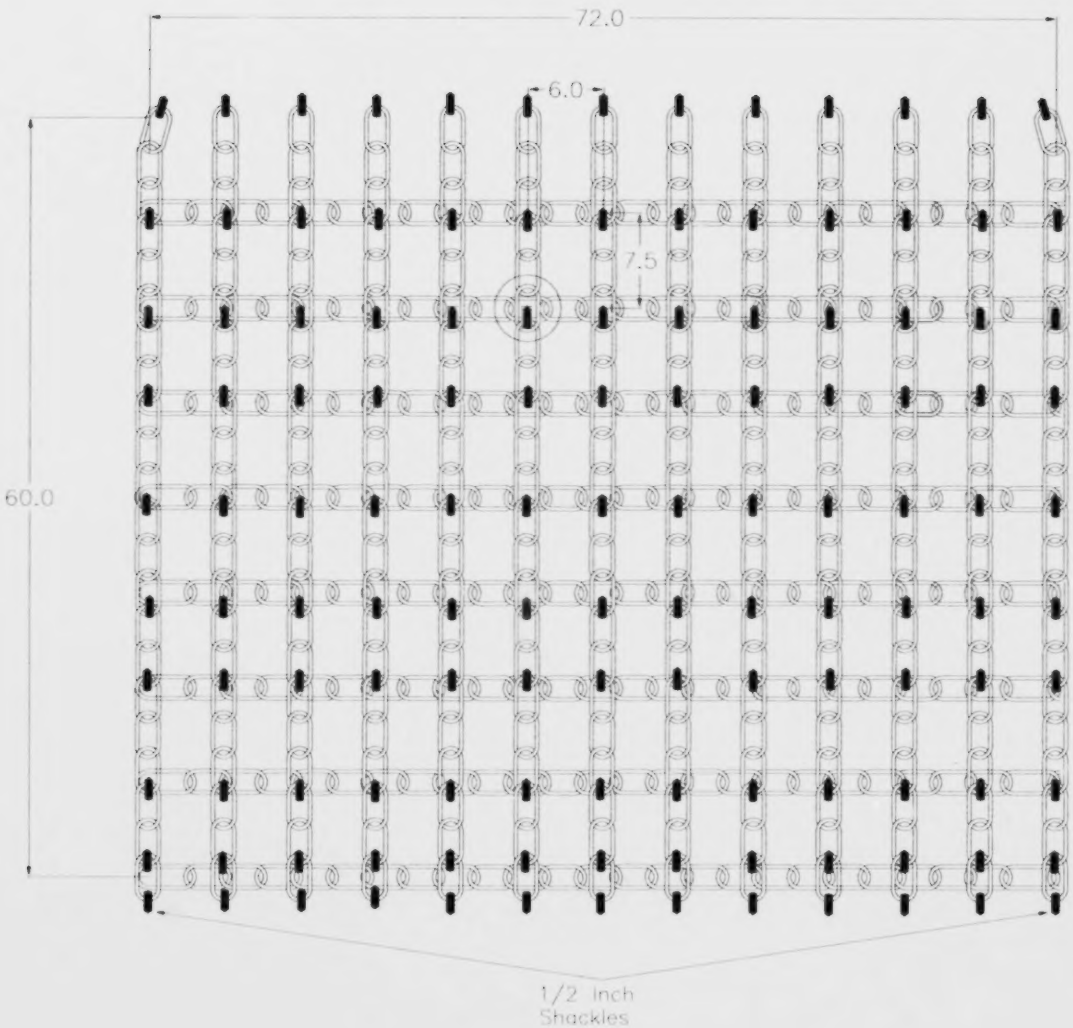

Figure 12: Chain mat showing overall dimensions, orientation of the vertical and transverse chains, as well as placement and size of shackles. All dimensions are in inches.

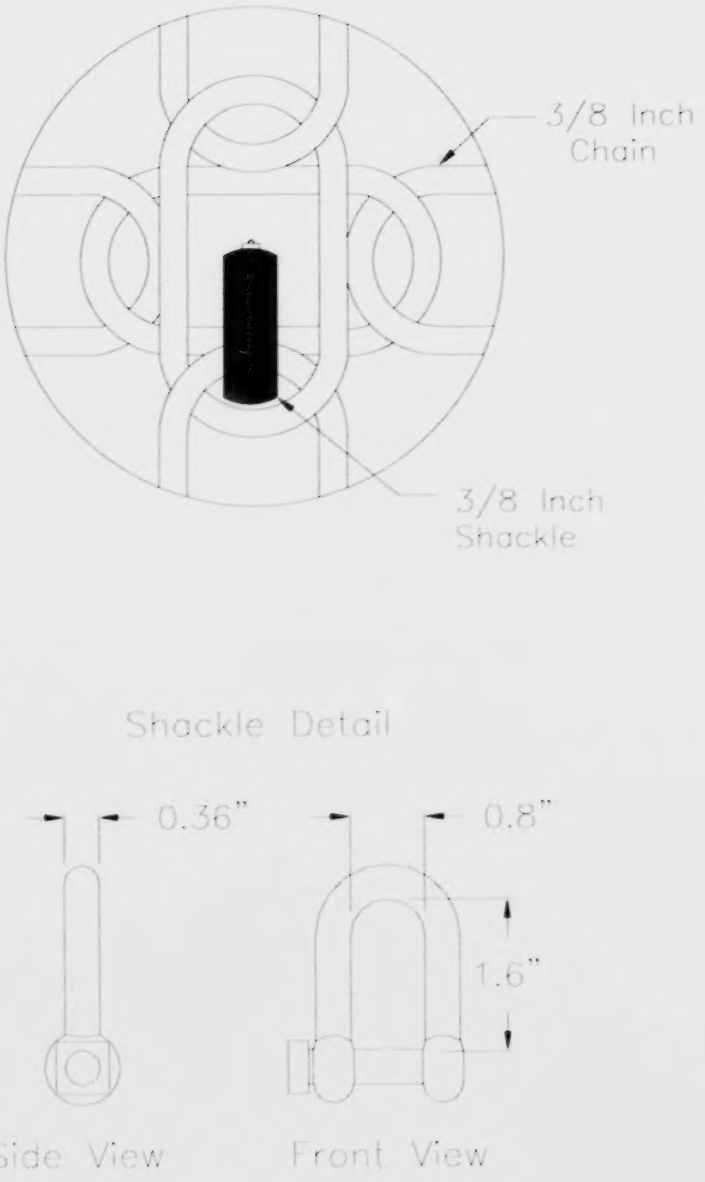

Figure 13: Close up detail of chain intersection, shackle placement, and shackle detail.

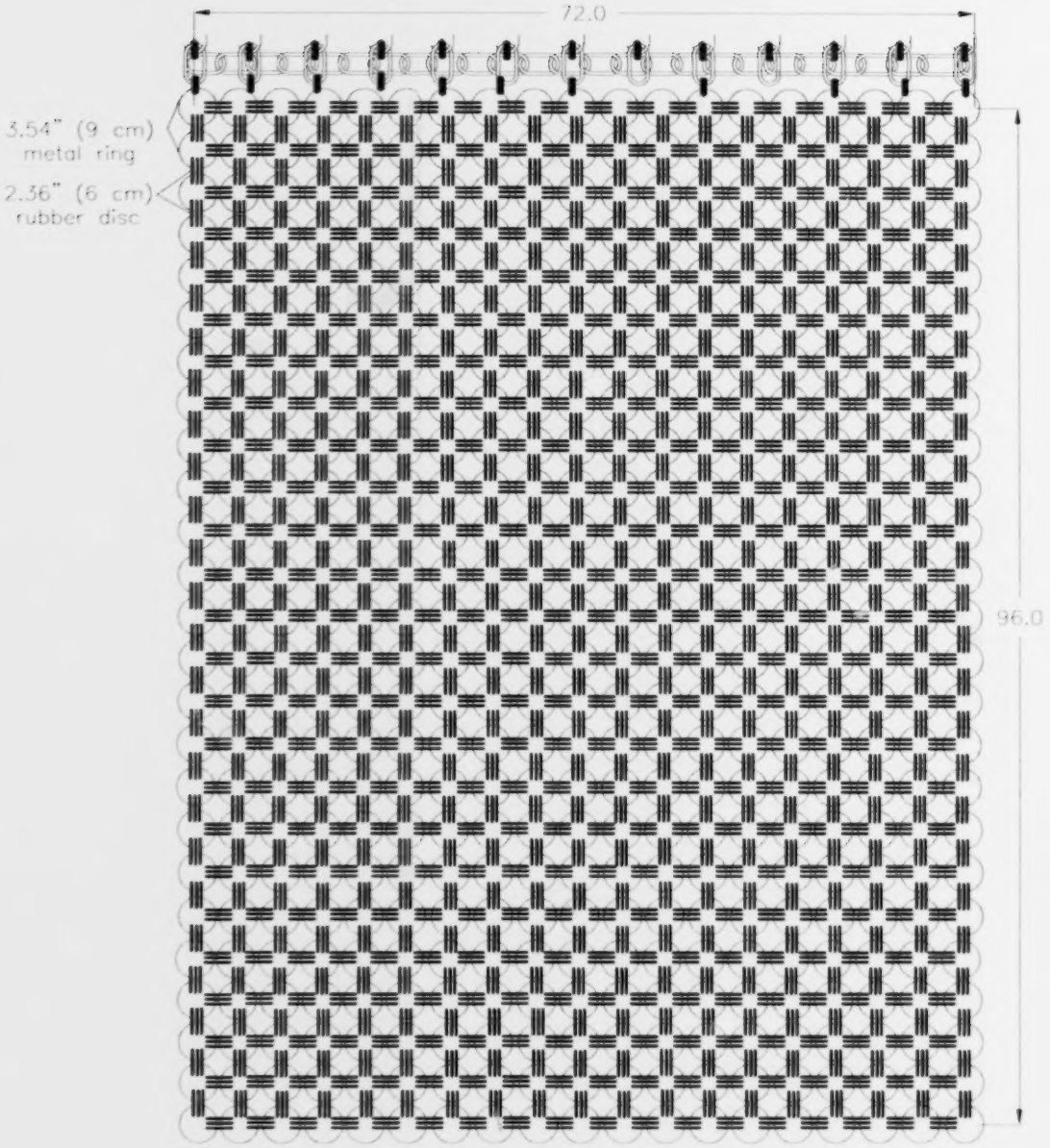

Figure 14: Chaffing mat showing overall dimensions, orientation of steel rings and rubber discs, and connection to chain grid. All dimensions are in inches.

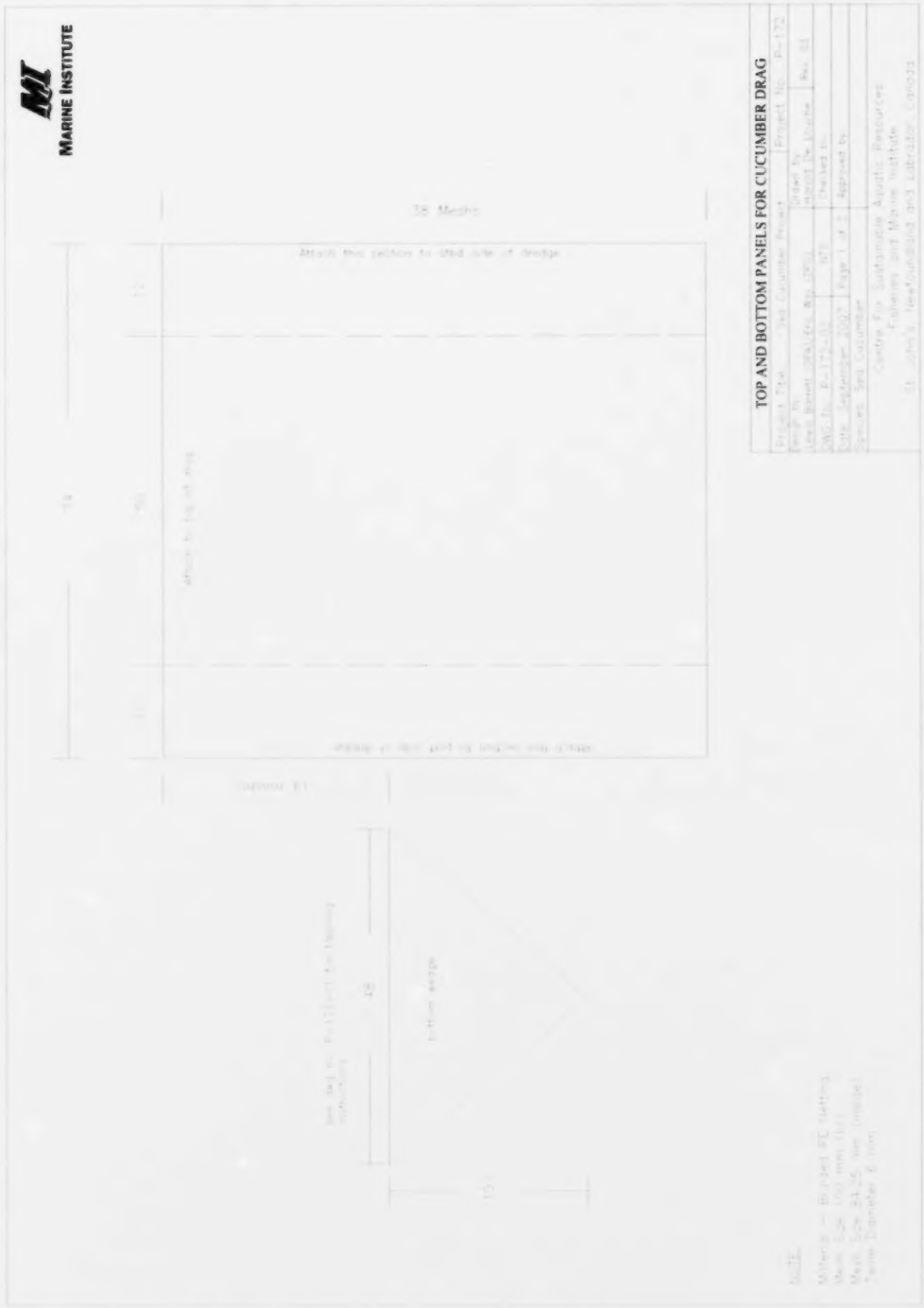

Figure 15: Details of the top and bottom panel of the net bag.

Figure 16: Close up detail of the bottom panel (wedge) including individual meshes and appropriate taper.

Table 1: Component identification and parts list.

Part No.	Description
1	1.5 inch round stock
2	1 inch round stock
3	0.75 inch round stock
4	2"x 3" x 0.375" flat bar
5	3" x 72" x 0.375" flat bar
6	3" x 69" x 0.375" flat tempered steel shoe
7	3" x 3" x 0.375" flat tempered steel
8	3" wide x 0.375" thick flat bar (upper ski)
9	3" wide x 0.375" thick flat tempered steel (lower ski)
10	6" x 72" x 0.375" flat bar
11	0.75" shackle
12	0.75" swivel
13	0.375" flat bar
14	0.375" shackle holes